REMARKS

Claims 2-11 are now pending in this application. Claim 1 is rejected and is cancelled herein. New claims 2-11 are added.

SUBSTITUTE SPECIFICATION AND ABSTRACT SUBMITTED

Applicant submits herewith a substitute specification and abstract wherein amendments are effected to place the text thereof into proper English in accordance with 37 CFR 1.125(c). The specification is also amended to explicitly incorporate the reference to the related ancestor applications of the present application, the amendment of which was obviated by the filing of the Application Data Sheet in the present application. Also accompanying this amendment is a reproduction of the original specification and abstract with markings indicating the amendments effected in the substitute specification in accordance with MPEP §608.01(q) and 37 CFR 1.125(b). No new matter is added. Entry of the substitute specification and abstract is respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

Claim 1 is rejected as indefinite under 35 U.S.C. § 112, second paragraph, for failing to particularly point out and distinctly claim the subject matter of the invention as a result of informalities stated in the Office Action. The claim is now cancelled rendering said rejection moot.

CLAIM REJECTIONS UNDER 35 U.S.C. § 102(b)

Claim 1 is rejected under 35 U.S.C. § 102(b) as being anticipated by JP '609 reference to Bridgestone. Claim 1 is now cancelled rendering the rejection moot. New claims 2-7 are now submitted and are similar to but differing in scope from claims 1-2 of U.S. Patent No. 6,602,367, issued in the parent application of the present application. Insofar as the subject matter of new claims 2 and 3 reflects that of the cancelled claim and in the event the Examiner considers asserting the present rejection against the new claims or making the next Office Action final, applicants submit the following remarks which were also submitted in support of issuance of claims 1-2 of U.S. Patent No. 6,602,367 and remain applicable.

Claim 2 recites that a first angle and a second angle are measured while the drum rotates in *a* drum rotational direction. Specifically, the claim recites:

> detecting arrival of a trailing end of said strip member at said first strip end sensor brought about by rotating said drum in said drum rotational direction;

The second angle is measured when the trailing end of the strip member is moved to the first strip end detector by the drum turning in the same direction as it turned to move the front end to the second strip end detector.

In contrast, the JP '609 reference requires that the drum direction be reversed. Specifically, JP '609 recites the following:

> The drum is reversed and the detector 16 detects the rear end 11B of the rubber sheet 11. See CONSTITUTION, Figs. 1A-1C, and Figs. 4A-4D.

Furthermore, the JP '609 reference does not appear to teach making a measurement of the first and second angles as claimed. Finally, the present invention mechanically simplifies the process by not requiring drum rotation direction reversal.

With regard to claims 4-8 and 10 the recitation for ceasing the winding operation or sounding an alarm is supported by the specification on page 8.

In view of the above, it is respectfully submitted that claims 2-7 particularly describe and distinctly claim elements not disclosed in the cited reference. Thus, the JP '609 reference cannot anticipate, nor render obvious the claimed invention.

CLAIM REJECTIONS BASED ON OBVIOUSNESS DOUBLE PATENTING

Claim 1 is are rejected under the judicially created doctrine of the "obviousness" type double patenting rejection as unpatentable over claims 1 and 2 of U.S. Patent No. 6,602,367.

Although claim 1 is now cancelled rendering the double patenting rejection moot, the assignee herein files, without prejudice, a terminal disclaimer in compliance with 37 CFR 1.321(b) pursuant to 37 CFR 1.78(d) in order to preempt any future double patenting rejection based on U.S. Patent No. 6,602,367.

TERMINAL DISCLAIMER FEE

A terminal disclaimer in compliance with 37 CFR 1.321(c) s herein filed. **The fee of $130.00 for the Terminal Disclaimer is provided for in the charge authorization presented in the PTO Form 2038, Credit Card P ıyment form, provided herewith.**

REQUEST FOR EXTENSION OF TIME

Applicant respectfully requests a three month extensior of time for respon·ling to the Office Action. **The fee of $1020.00 for the extensi»n is provided for in the charge authorization presented in the PTO Form 2038, Credit Card Payment form, provided herewith.**

If there is any discrepancy between the fee(s) due and th·: fee payment authorized in the Credit Card Payment Form PTO-2038 or the Form PTO-2038 is missin·g or fee payment via the Form PTO-2038 cannot be processed, the USPTO is hereby authorized to charge any fee(s) or fee(s) deficiency or cre lit any excess payme ıt to Deposit Account No. 10-1250.

In light of the foregoing, the application is now believed to be in proper form for allowance of all claims and notice to that effect is earnestly solicited.

Respectfully submitted,
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enc: Form PTO-2038; Terminal Disclaimer; Substitute Specification; and Marked reproduction of original specification.

MARKED SPECIFICATION

F-7906 Ser. No. 10/628,612

METHOD FOR WINDING STRIPS ON THE BUILDING MACHINE

This is a Continuation of Application Serial No. 09/804,56' filed March 12, 2001, now issued as U.S. Patent No. 6,602,367, which is a Divisional of 08/943,068 filed October 2, 1997, now abandoned, which is a Continuation of 08/625,989 filed April 1, 1996, now abandoned, which is a Continuation of 08/400,302 filed March 16, 1995, now abandoned, which is a Continuation of 08/187,775 filed January 26, 1994, now abandoned, which is a Continuation of 07/666,099 filed March 7, 1991, now abandoned.

BACKGROUND OF THE INVENTION

1. Technical Field

The inventions disclosed in this application relate to methods for winding an automotive tire building strip member on a building drum.

More particularly, the first invention in this application provides a method for winding a strip member, such as rubberized steel cord, tread rubber or the like, precut to the circumferential length of the building drum of a tire

building machine, on [[said]] the building drum in such a manner that both ends of the strip member will be exactly abutted against each other on the drum.

The second invention in this application relates to an automotive tire building device wherein the lapping margin of ends of a strip member wound on [[its]] a building drum can be automatically measured.

2. Prior Art

In winding a tire strip member on a building drum, it is at times required to insure exact abutment of its ends and at other times required that the lapping margin (positive and negative) be within certain allowable limits.

As a technology for insuring exact abutment of both ends of a strip member, such as rubberized steel cord or tread rubber, in the winding thereof on the building drum of an automotive or other tire building machine, there is known [[the]] a method described in Japanese Patent Publication No. 61-32980. According to this method, the length of the strip precut to the circumferential length of the building drum is measured and, then, a leading portion, of predetermined length, of the strip is taken up on the building drum at the feeding

(takeup) speed equal to the peripheral speed of the drum. Then, the feeding speed relative to the building drum speed is altered to either compress or stretch the strip while its intermediate portion is wound on the building drum. Finally, the feeding speed is re-equalized with the peripheral speed of the building drum to wind up the remaining portion of the strip member on the drum.

However, the strip member tends to shrink with the progress of time after cutting and the time to termination of shrinkage and the amount of shrinkage [[are]] is dependent on the environment and other conditions. Under certain conditions, the amount of post-cutting shrinkage reaches as much as about 0.5%. Mor over, the length of the strip member varies with the magnitude of the tension that acts on the strip when it is transferred from a transfer conveyer to the building drum and the pressure of contact between the strip and the drum. In the prior art method mentioned above the total length of the strip member is measured while it is undergoing shrinkage after cutting and the ratio of the feeding speed to the peripheral speed of the building drum is set according to the length value thus found so as to compress or stretch the intermediate portion of the strip. As a consequence, the aforesaid ratio is often irrelevant and there occurs an excess or a shortage of compression or stretching

of the strip member, thus causing a lapping of the leading and trailing ends of the strip member or a gap therebetween.

Therefore, in the first invention in this application provides a winding method which insures exact abutment of ~~said~~ the ends or abutment without an appreciable overlap or gap.

Furthermore, in the process of manufacture of an automotive tire, not only the steel cord and tread rubber mentioned above but a variety of other rubber-based strip members are cut to length and both ends thereof are joined to build single-layer or multi-layer ring or cylindrical members. For example, on the primary building machine, an inner liner (a strip member of rubber) and a plurality of ply cords (rubberized fiber cords or steel cords), all preset to the circumferential length of the building drum, are laid up on the peripheral surface of the drum. In the secondary building machine, two steel belts (rubberized steel cords), a cap ply (rubberized nylon cord), etc. are laid up some of these different strip members are not joined by abutment at ends as described above but are joined by lapping the trailing end over the leading end on the drum. As mentioned above, the strip member has the property to shrink on standing after cutting to length as mentioned above and the amount of this shrinkages varies

with changes in environment. Also as mentioned above, the length of the strip member is altered by external forces that act on the strip when it is transferred from the conveyer to the drum. Therefore, even if the strip member has been cut precisely to length, a variation is inevitable in the degree of lapping of both ends. Therefore, it is common practice for the operator to trim off the rubber or cord at the trailing end when the degree of lapping is too large or unwind the strip partway and rewind it with stretching when there is a gap between ends.

However, the conventional tire building machine is not equipped with very effective means for inspecting the end joint of ~~said~~ the strip member and the current trend toward automation of tire building cannot completely avoid a risk of products with ~~said~~ the surplus or deficiency in end lapping being shipped uncorrected and marketed.

Accordingly the second invention in this application provides a tire building device which is capable of detecting a surplus or deficiency in end lapping while a strip member is wound on a building drum of ~~said~~ the primary or second building machine.

SUMMARY OF THE INVENTION

MARKED SPECIFICATION

The method for winding a strip member on a tire building machine in accordance with the first invention in this application comprises feeding a strip member to a building drum by means of a transfer conveyer, taking up ~~said~~ the strip member on ~~said~~ the building drum while controlling the speeds of ~~said~~ the transfer conveyer and building drum and joining free ends of the strip member, which method is characterized by setting the feeding speed of ~~said~~ the transfer conveyer and the peripheral speed of ~~said~~ the building drum to equal values, taking up a leading portion, of predetermined length, of ~~said~~ the strip member on the building drum, detecting the position of a trailing end of ~~said~~ the strip member on ~~said~~ the transfer conveyer to calculate the length of a trailing portion following ~~said~~ the leading portion of ~~said~~ the strip member, setting the ratio of the feeding speed of ~~said~~ the transfer conveyer to the peripheral speed of ~~said~~ the building drum to the ratio L/Lo, where L is the length of ~~said~~ the trailing portion and Lo is the residual circumferential length of ~~said~~ the building drum, only when the L/Lo ratio is within a set range and taking up the trailing portion of ~~said~~ the strip member, while the takeup of the trailing portion of ~~said~~ the strip member is stopped when the ratio L/Lo deviates out of ~~said~~ the set range.

Thus, after completion of the takeup of a leading portion of the strip member or just before the beginning of takeup of a trailing portion of the strip

member, the length of the trailing portion is measured and the trailing portion is wound only when the ratio L/Lo of the length of the trailing portion of the strip member to the residual circumferential length Lo of the building drum is within a set range, with the ratio of the feeding speed to the peripheral speed of the building drum being set to ~~said~~ the ratio L/Lo, with the result that the error of length L of the trailing portion of the strip member is minimized to preclude an excessive overlap or gap between ends of the strip member, thus leading to exact abutment of the ends or a minimum of overlap or gap.

The length of the leading portion of ~~said~~ the strip member is preferably set to 30.about.80% of one circumferential length of the building drum. If the set length is less than 30%, installation of a leading end sensor is difficult. Conversely if the set length is over. 80%, the stretching or compression of the strip member is concentrated in the trailing portion thereof to adversely affect the quality of the product.

The [[said]] ratio L/Lo applicable to the case of continued takeup of the trailing portion of the strip member is preferably set within the range of 0.995.about.1.005. Outside of this range, the amount of stretching or compression becomes too great to insure the proper winding.

The method of winding the strip member in accordance with the second invention in this application comprises using a tire building machine having a building drum for taking up a tire building strip member of predetermined length endlessly and a transfer conveyer for feeding ~~said~~ the strip member to ~~said~~ the building drum, which method is characterized by detecting the winding-start end of ~~said~~ the [[trip]] strip member transferred from ~~said~~ the transfer conveyer to ~~said~~ the building drum and the winding-finish end of ~~said~~ the strip member with end sensors, measuring the angle through which ~~said~~ the building drum has rotated from the output of a winding start signal to the output of a winding finish signal in response to output signals from ~~said~~ the sensors by means of an angle detector, and calculate a lapping margin between the winding start end and the winding finish end of ~~said~~ the strip member based on the rotational angle and diameter of ~~said~~ the building drum by means of an operational means.

In the above method, since the lapping margin between the two ends of the strip member is calculated by ~~said~~ the operational means, the building operation can be continued while ~~said~~ the lapping margin is within a preset allowable range or the operation can be discontinued or an alarm be actuated when the lapping margin deviates out of ~~said~~ the allowable range, that is to say

when the lapping margin is too large or too small. Therefore, in the automatic building process for car tires, the risk of products with lapping defects being shipped can be effectively prevented.

It may be so arranged that one end sensor of the above-described type is used to detect both the winding start and winding, finish ends of the strip member or that two such end sensors are installed apart from each other by an optional angle along the circumferential direction of the building drum so that one of the sensors is used to detect the winding start end with the other sensor detecting the winding finish end.

Furthermore, a still more improved accuracy may be insured by installing end sensors in a plurality of positions, for example in the center and in positions on both sides thereof, Moreover, to cope with the case in which one strip member has an intermediate joint of material and this joint builds a step, it may be so arranged that the trailing end sensor is rendered operative only within a certain range, for example in the range of 5 mm, before and after the winding start end, whereby the risk of ~~said~~ the joint being mistaken for the winding finish end and detected as such.

In the second invention in this application, the lapping margin of the strip member wound on the building drum includes both a positive value and a negative value. In other words, the case in which the two ends of the strip member actually overlap and the case in which there is a gap between the ends are included. The winding operation is stopped when the actual overlap or gap is too great or too small.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view showing an example of the first invention in this application.

FIG. 2 is a view similar to FIG. 1, showing an example of the second invention in this application.

FIGS. 3 and 4 each is a schematic side view of the building drum, which explains the operation of the example shown in FIG. 2.

~~PREFERRED EMBODIMENTS OF THE INVENTION~~

MARKED SPECIFICATION

F-7906 Ser. No. 10/628,612

DETAILED DESCRIPTION

FIG. 1 shows an example of the first invention in this application.

As illustrated, A stands for a tire steel belt, that is to say a strip member, 1 for a transfer conveyer therefor, 2 for an end pulley, 3 for a guide pulley, 4 for a drive pulley, and 5 for a building drum. The drive pulley 3 is connected to a drive shaft of a transfer servo motor 6 and the rotation of this servo motor 6 is controlled by a transfer servo amplifier 7. The rotational speed of ~~said~~ the transfer servo motor 6 is detected by a pulse oscillator 8 and fed back to ~~said~~ the servo amplifier 7. On the other hand, ~~said~~ the building drum 5 is connected to a drive shaft of a drum servo motor 9 and the rotation of this drum servo motor 9 is controlled by a servo amplifier 10. The rotational speed of ~~said~~ the drum servo motor 9 is detected by a pulse oscillator 11 and fed back to ~~said~~ the servo amplifier 10.

Disposed over ~~said~~ the building drum 5 is a leading end sensor 12 for contactless detection of a front end Aa of ~~said~~ the strip member A and [[the]] an output of ~~said~~ the leading end sensor 12 is connected to a sensor amplifier 13. On the other hand, a trailing [[end]] sensor 14 for detecting the position of the

trailing end Ab of strip member A is installed over the transfer conveyer 1. ~~The output~~ Output terminals of [[this]] the trailing end sensor 14 and ~~said~~ the sensor amplifier 13 are respectively connected to a trailing length meter 15 for calculating the length L of a trailing portion (the length from point P to Ab) of ~~said~~ the strip member A. When the leading portion of strip member A is progressively wound on the building drum 5 and the leading end Aa of strip member A is detected by ~~said~~ the leading end sensor 12, the trailing end sensor 14 detects the position of the trailing end Ab of strip member A and ~~said~~ the trailing length meter 15 calculates the length L of the trailing portion of A which is still to be wound on the building drum 5.

The output terminal of ~~said~~ the trailing length meter 15 is connected to a speed ratio calculator 16. This speed ratio calculator 16 calculates the ratio L/Lo of the length L of ~~said~~ the trailing portion to [[the]] a length of strip member A which is still to be wound on the building drum 5, that is the residual circumferential length Lo (length from point P to Aa) and transmits a signal corresponding to [[this]] the ratio to ~~said~~ the transfer servo amplifier 17 and drum servo amplifier 10. Only when ~~said~~ the ratio L/Lo is within a set range, the transfer conveyer 1 and building drum 5 are driven at a speed ratio corresponding to the ratio L/Lo. On the other hand, when the ratio L/Lo deviates

from ~~said~~ the set range, the transfer conveyer 1 and building drum 5 are respectively stopped.

In winding a strip member A having a total length of 2,000 mm on a building drum having a circumferential length of 2,000 mm, the length of the leading portion of strip member A is set to 1,500 mm (75% of the total length) and the speed of the transfer conveyer 1 and the peripheral speed of the building drum 5 are set to the same value. In this condition, the leading portion, which is 1,500 mm long, of ~~said~~ the strip member A is taken up on the drum. As the leading end Aa of this strip member A is detected by the leading end sensor 12, the trailing end sensor 15 ~~is caused to detect~~ detects the position of the trailing end Ab of strip member A and the trailing end length meter 15 ~~to calculate~~ calculates the length L of the trailing portion of the strip member A. Then, the ratio L/Lo of this length L of the trailing portion to the known residual circumferential length Lo of the building drum 5 is calculated and when this ratio L/Lo is within the range of 0.995 to 1.005, (when L/Lo is -2.5 mm ~ 0 mm), the ratio between the peripheral speed of the building drum 5 and the feeding speed of the transfer conveyer 1 is set to ~~said~~ the L/Lo so that the strip member A is taken up under tension, i.e. under a stretching force, on the building drum, whereby the leading and trailing ends of the strip member A are

exactly abutted against each other without any surplus or deficiency. However, when the ratio L/Lo deviates from the above-mentioned range, the transfer belt 1 and the building drum 5 are respectively stopped and the strip member A is removed.

FIGS. 2 through 4 show an embodiment of [[the]] a second invention in this application.

Referring to FIG. 2, A stands for a strip member, 1 for a transfer conveyer, 2 for a belt pulley and 5 for a building drum. The building drum 5 and transfer conveyer 1 are driven in the direction of the ~~arrowmark~~ arrow marks to wind the strip member A on the building drum 5.

Along the path in the direction of advance of ~~said~~ the building drum 5 from point P where the strip member A begins to contact the drum 5, there are provided a first end sensor 25 and a second end sensor 26. [[These]] The end sensors 25 and 26 each ~~comprises~~ comprise a photoelectric element which photoelectrically detects the end of the strip member A. Connected to ~~said~~ the building drum 5 is an angle detector 30 through a toothed pulley 27, a toothed belt 28 and a toothed pulley 29. The output terminals of ~~said~~ the first end sensor

25, second end sensor 26 and angle detector 30 are respectively connected to an operational unit 31 which calculates a degree of end lapping of ~~said~~ the strip member A.

In the above arrangement, as the building drum 5 and transfer conveyer 1 are driven to take up the strip member A on the building drum 5 and the leading end Aa of ~~said~~ the strip member A reaches the position of ~~said~~ the first end sensor 25, the angle detector 30 is actuated and as the same leading end Aa then reaches the position of ~~said~~ the second end sensor 26, the angle of rotation of ~~said~~ the building drum 5 from the time of detection of the leading end Aa by the first end sensor 25 to the time of detection of the same end Aa by ~~said~~ the second end sensor is measured. Then, based on this measured angle of rotation, the angle .theta..sub.0 (degrees) from the second end sensor 26 to the first end sensor 25 is calculated and ~~memorized~~ stored by ~~said~~ the operational unit 31 and, at the same time, the indicator of the angle detector 30 is reset to zero. Then, as the first end sensor 25 detects the trailing end Ab of strip member A (FIGS. 3 and 4), the building drum 5 stops rotating and the angles of rotation .theta..sub.1 and .theta..sub.2 (degrees) are measured.

FIG. 3 shows the situation where the angle of rotation .theta..sub.1 (degrees) is larger than the angle .theta..sub.0 between the two end sensors 25 and 26 and the end Aa and Ab of the strip member A overlap. The lapping margin X in this situation is defined as follows.

$$(D + 2t)\,\pi \times \frac{\theta_1 - \theta_0}{360} = X$$

where D is the diameter of the building drum 5 and t is the thickness of strip member A.

This value of X is calculated by ~~said~~ the operational means 71.

FIG. 4 shows the situation where the angle of rotation .theta..sub.2 (degrees) is smaller than the angle .theta..sub.0 between the two end sensors 25 and 26 and there is a gap between the ends Aa and Ab of the strip member A. The gap Y in this situation is given by the following equation

$$(D + 2t)\,\pi \times \frac{\theta_0 - \theta_2}{360} = Y$$

where D is the diameter of the building drum 5 and t is the thickness of the strip member A.

This value of Y is calculated by ~~said~~ the operational means 31.

While the above embodiment employs two end sensors 25 and 26, the second end sensor 26 shown in FIG. 2 may be dispensed with and only the first end sensor 25 be used to determine the angle corresponding to approximately one turn. However, when two end sensors are used in the above embodiment, the change in length between the two sensors 25 and 26 can be disregarded and a more accurate measurement can be realized. It should be understood that in building the second and subsequent layers of strip member A, the thickness of strip member A already taken up is added to the diameter D of the building drum.

MARKED SPECIFICATION

F-7906 Ser. No. 10/628,612

Abstract

A strip member is wound by a tire building machine having a building drum for taking up a strip member of predetermined length without discrete ends and a transfer conveyor for feeding the strip member to the building drum. The winding-start end of the strip member transferred from the transfer conveyor to the building drum and the winding-finish end of the strip member are detected by means of end sensors, measuring the angle through which the building drum has rotated from the output of a winding start signal to the output of a winding finish signal in response to output signals from the sensors by means of an angle detector. A lapping margin between the winding start end and the winding finish end of the strip member is calculated based on the rotational angle and diameter of the building drum by means of an operational means.